Complete Summary

GUIDELINE TITLE

Difficult Airway Society guidelines for management of the unanticipated difficult intubation.

BIBLIOGRAPHIC SOURCE(S)

Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004 Jul;59(7):675-94. [314 references] PubMed

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Unanticipated difficult intubation

GUIDELINE CATEGORY

Management

CLINICAL SPECIALTY

Anesthesiology
Critical Care
Emergency Medicine
Surgery

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To present guidelines for the management of the unanticipated difficult intubation in an adult non-obstetric patient, to justify the choice of techniques, and to discuss alternative management strategies

TARGET POPULATION

Adult non-obstetric patients undergoing intubation

Note: Paediatric and obstetric patients, and patients with upper airway obstruction, are excluded.

INTERVENTIONS AND PRACTICES CONSIDERED

1. Direct laryngoscopy
2. Tracheal intubation
3. Fibreoptic tracheal intubation through intubating laryngeal mask airway (ILMA™) or laryngeal mask airway (LMA™) (or ProSeal LMA™)
4. Maintenance of oxygenation and ventilation using face mask (postponement of surgery and awakening)
5. Cannula or surgical cricothyroidotomy (rescue technique)

MAJOR OUTCOMES CONSIDERED

Not stated

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The published literature on difficult and failed tracheal intubation was reviewed with extensive Medline searches and use of personal bibliographies. Advice was sought from members who had particular expertise or knowledge.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

A prototype flow-chart was presented at the Difficult Airway Society (DAS) Annual Scientific Meeting in November 2000. There was debate and criticism, and constructive suggestions were received at the meeting and subsequently by electronic mail. The Disease Airway Society executive committee examined the flow-charts in detail at several meetings. Development was based on evidence, experience, and consensus. Revised flow-charts were presented at the Disease Airway Society Annual Scientific Meetings in November 2001 and 2002. There was overwhelming support for the concept and content of the flow-charts.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

A late version of the paper was sent for comments to 27 Difficult Airway Society (DAS) members who had been particularly involved in the guidelines discussions. Their comments were considered during preparation of the final version.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Overview

The essence of the Difficult Airway Society (DAS) guidelines for management of unanticipated difficult tracheal intubation is a series of flow-charts. They should be used in conjunction with the original guideline document.

The DAS flow-charts are based on a series of plans. The philosophy of having a series of plans is well established in airway management, as no single technique is always effective. Effective airway management requires careful planning so that back up plans (plan B, C, D) can be executed when the primary technique (plan A) fails. This philosophy forms the basis of the DAS guidelines. It is hoped that anaesthetists will always make back-up plans before performing primary techniques so that adequate expertise, equipment, and assistance are available.

Two other principles are particularly important. Maintenance of oxygenation takes priority over everything else during the execution of each plan. Anaesthetists should seek the best assistance available as soon as difficulty with laryngoscopy is experienced.

The basic structure of the DAS flow-charts is shown in figure 1 of the original guideline document. This contains the plans and core techniques, and shows the possible outcomes. The plans are labelled A-D:

Plan A: Initial tracheal intubation plan

Plan B: Secondary tracheal intubation plan, when Plan A has failed

Plan C: Maintenance of oxygenation and ventilation, postponement of surgery, and awakening the patient, when earlier plans fail

Plan D: Rescue techniques for "can't intubate, can't ventilate" (CICV) situation

Not all these plans are appropriate to every possible scenario (vide infra). The outcome of each plan determines progress to subsequent plans. In some situations, progress depends upon clinical factors, such as the best view of the larynx. Subdivision of the Cormack & Lehane grade 3 into 3a (epiglottis can be lifted) and 3b (epiglottis cannot be lifted from the posterior pharyngeal wall) has a significant effect on the success of the introducer (bougie) and fibreoptic techniques.

It was not possible to develop a single detailed flow-chart to cover all clinical scenarios. Detailed flow-charts have therefore been developed for each of the following:

1. Unanticipated difficult tracheal intubation-during routine induction of anaesthesia in an adult patient
2. Unanticipated difficult tracheal intubation-during rapid sequence induction of anaesthesia (with succinylcholine) in a non-obstetric patient
3. Failed intubation, increasing hypoxaemia, and difficult ventilation in the paralysed, anaesthetised patient, the "can't intubate, can't ventilate" situation

The principal points of these plans are discussed in more detail. Practical details of some techniques are outlined, but full descriptions should be sought in the references and textbooks. The techniques should be practised under supervision in elective situations, where appropriate, and in manikins.

Scenario 1: Unanticipated difficult tracheal intubation - during routine induction of anesthesia in an adult patient (Refer to figure 2 of the original guideline document for a flow chart depicting this scenario.)

This is the clinical scenario of difficult intubation in an adult patient after induction of general anaesthesia and muscle paralysis, usually with a non-depolarising neuromuscular blocking drug.

Plan A: Initial tracheal intubation plan

The first attempt at direct laryngoscopy should always be performed in optimal conditions after ensuring adequate muscle relaxation and appropriate position of the head and neck (normally the "sniffing" position of head extension and neck flexion). Use of optimum external laryngeal manipulation (OELM) or backward, upward, and rightward pressure (BURP) on the thyroid cartilage, if required, applied with the anaesthetist's right hand, should be an integral part of this first attempt. If, despite these measures, there is still a grade 3 or 4 view, then alternative techniques will be needed. These techniques include use of an introducer ("gum elastic bougie") and/or a different laryngoscope. Alternative direct laryngoscopes of proven value include the McCoy and straight laryngoscopes. The choice of technique depends upon the experience of the anaesthetist with a particular technique. Oxygenation is maintained with mask ventilation between intubation attempts.

The Eschmann tracheal tube introducer ("gum elastic bougie") was designed for multiple use and was marketed in the United Kingdom (UK) in the early 1970s. It differs from previous introducers in its greater length (60 cm), angled tip, and the combination of flexibility and malleability. It is inexpensive and readily available, and the technique combined simplicity of operation with a high success rate. It is passed blindly into the trachea when the laryngeal inlet is not visible. The most widely used technique in the UK is the combination of the multiple-use bougie (introducer) with the Macintosh laryngoscope. There is evidence that the bougie is more effective than the stylet when the best view of the larynx is grade 3.

The bougie technique should be used in an optimal way. The Macintosh laryngoscope is left in the mouth and attempts are made to insert the bougie

blindly into the trachea. It is important to maximise the chance of the bougie entering the trachea. The anaesthetist will not see the bougie entering the larynx when the laryngoscopy view is grade 3 or 4. Therefore it is important to be able to recognise whether the bougie is in the trachea or the oesophagus. Clicks can often be felt by the anaesthetist when the bougie is passed into the trachea. These are caused by the tip of the bougie hitting the tracheal cartilages. Clicks are more likely to be elicited if the distal end of the bougie is bent into a curve of about 60 degrees. If clicks are present, proceed with intubation by passing ("railroading") the tube over the bougie (vide infra). Clicks will not be present if the bougie goes down the center of the tracheal lumen or is in the oesophagus. If clicks are not elicited, the bougie should be advanced gently to a maximum distance of 45 cm. If distal hold-up is sensed as slight resistance to further advancement, indicating that the bougie is held up in the bronchial tree, proceed with intubation. If the patient is not fully paralysed, coughing may indicate the presence of the bougie in the trachea. If neither clicks, hold-up, nor coughing are elicited, the bougie is probably in the oesophagus. Remove the bougie and consider another attempt at passing the bougie blindly into the trachea-if the laryngeal view is 3a.

Once the bougie is in the trachea, the tracheal tube is railroaded over the bougie. Railroading is facilitated if the laryngoscope is kept in the mouth and the tube is rotated 90 degrees anticlockwise. Use of a small tube, reinforced tube, the tube (Euromedical ILM) supplied with the Intubating Laryngeal Mask, and the Parker tube have all facilitated railroading in flexible fibreoptic intubation. By analogy, it is probably that these tube factors will facilitate railroading with the Eschmann introducer.

Success rates with the original reusable Eschmann introducer in prospective studies have varied between 94.3%, 99.5%, and 100%. Optimum results depend on regular use and experience. However, the technique is of limited value when it is not possible to elevate (grade 3b) or visualise (grade 4) the epiglottis. There are concerns that some recently introduced single-use disposable introducers are not as effective as and may cause more trauma than the original multiple-use bougie.

Alternative techniques of laryngoscopy, of proven value, may be used by those experienced in these techniques. In particular there is considerable evidence of the value of the following techniques in experienced hands:

- Direct use of the flexible fibreoptic laryngoscope
- Bullard-type laryngoscope

There are situations in which these techniques can offer unique advantages. The lighted stylet is not a visual technique, but may be successful in experienced hands.

Multiple and prolonged attempts at laryngoscopy and tracheal intubation are associated with morbidity and mortality. The extent of laryngeal oedema may not become apparent until fibreoptic examination or extubation. An essential component of Plan A is therefore to limit the number and duration of attempts at laryngoscopy in order to prevent trauma and development of a "can't ventilate" situation. It is difficult to justify use of the same direct laryngoscopy more than twice, and the maximum number of laryngoscope insertions should be limited to

four. However, tracheal intubation may be successful when it is performed by a more experienced anaesthetist and one such additional attempt is worthwhile.

When these attempts at tracheal intubation have been unsuccessful, Plan B should be implemented.

Plan B: Secondary Tracheal Intubation Plan

A different approach is required when direct laryngoscopy has failed. Alternative techniques can allow continuous ventilation and oxygenation both during and between intubation attempts. This is best achieved by using a "dedicated airway device," defined as "an upper airway device which maintains airway patency while facilitating tracheal intubation." Although the classic laryngeal mask airway (LMA™) has been recommended as a ventilation and intubation device in patients with a difficult airway, it was not designed as a conduit for tracheal intubation and has clear limitations when used for this purpose (vide infra). Any other supraglottic airway device could be used, but the intubating laryngeal mask (ILMA™) was designed specifically to facilitate tracheal intubation while maintaining ventilation. Each of these devices has advantages and disadvantages.

ILMA™ for secondary tracheal intubation: Numerous reports have confirmed the effectiveness of the ILMA™ for both ventilation and blind intubation in patients without airway difficulties. The overall intubation success rate in 1,100 patients in these studies was 95.7%. Further studies have confirmed its value in management of patients with known or anticipated difficult tracheal intubation. The ILMA™ has also proved to be a useful device in the management of unanticipated difficult intubation. In one study, blind intubation was performed in 20 out of 23 patients with a 75% success rate at the first attempt (10% required two or three attempts and 5% required four attempts) and 100% overall success rate. Fibreoptic guided intubation was successful at the first attempt in the remaining three patients.

Although high success rates can be achieved with a blind technique, several attempts may be required and the incidence of oesophageal intubation can be up to 5%. Transillumination techniques may improve first-attempt success rates and certainly reduce the number of manoeuvres required, the incidence of oesophageal intubation, and the time required to achieve intubation. However, intubation under vision through the ILMA™ using a flexible fibreoptic laryngoscope has real advantages. The first-attempt and overall success rates are higher than blind techniques, and it nearly always succeeds when blind intubation fails.

The techniques of insertion and intubation through the ILMA™ differ in many respects from the classic LMA™, and training and practice are essential if it is to be used to achieve a high success rate and minimise trauma in the unanticipated difficult tracheal intubation. A learning curve of about 20 insertions has been described. The manufacturer's instruction manual describes the insertion and intubation techniques, the adjustments necessary for ideal positioning of the device, and an approach to problem-solving. The "Chandy manoeuvre" (alignment of the internal aperture of ILMA™ and the glottic opening by finding the degree of sagittal rotation which produces optimal ventilation, and then applying a slight anterior lift with the ILMA™ handle) facilitates correct positioning and blind intubation through the ILMA™ and has been shown to reduce the number of

intubation attempts. Use of the dedicated silicone tracheal tube is strongly recommended. The fibrescope can be used to visualise the "Epiglottic Elevator Bar" lifting the epiglottis and observe passage of the tracheal tube through the glottis or it can be passed into the trachea after glottic visualisation and then used to railroad the tube. The DAS prefers the latter technique. The lubricated silicone tracheal tube is first inserted into the shaft of the ILMA™ until its tip reaches the mask aperture (indicated by the transverse line on the tube). The fibrescope is then inserted through the tracheal tube so that its tip is just within the tip of the tube. The tube and fibrescope are then advanced together for about 1.5 cm so that the "Epiglottic Elevator Bar" is seen to elevate the epiglottis. Once the tip of the tube is in the larynx, the fibrescope is advanced into the trachea and the tube is then railroaded over it. Finally, the position of the tube is checked with the fibrescope during withdrawal. Oxygen and anaesthetic gases can be delivered continuously if a self-sealing bronchoscope connector is attached between the 15-mm tracheal tube connector and the anaesthetic breathing system. Ventilation is maximised by using a wide tracheal tube with a narrow fibrescope. The ILMA™ should be removed when tracheal intubation has been verified and the tracheal tube secured.

Classic LMA™ for secondary tracheal intubation: Fibreoptic tracheal intubation through the classic LMA™ (the role of the single-use LMA™ in management of the difficult airway patient has not been established) should be considered when ILMA™ is not available. Although Heath reported a 93% success rate for blind intubation through the LMA™ (in the absence of cricoid pressure), others have achieved much lower success rates, and blind intubation cannot be recommended. Success rates of 90 to 100% (depending on technique, equipment, number of attempts allowed and experience of user) can be achieved with fibreoptic intubation through the classic LMA™. The limitations of the classic LMA™ as a conduit for intubation are well known and include the following:

- The LMA™ tube connector is narrow and will allow for a 6-mm (internal diameter [ID]) tracheal tube through a size 3 or 4 LMA™ and 7 mm (ID) through a size 5 LMA™
- The LMA™ tube is so long that the cuff of an uncut normal tracheal tube (26 to 27 cm) may lie between the vocal cords so that it is ineffective and potentially traumatic. A long flexometallic tube, nasal RAE or a microlaryngeal tube is recommended.
- The mask aperture bars may obstruct the passage of the tracheal tube
- Manipulation requires head and neck movement and/or finger insertion, both of which may worsen difficulties.

Difficulties may be encountered during subsequent removal of the LMA™. The LMA™ may be left in situ if its presence does not interfere with surgical access. Techniques of LMA™ removal without dislodging the tracheal tube have been described, but they may fail and expose the patient to avoidable danger.

The problems mentioned above can be avoided by using a two-stage technique with a flexible fibreoptic laryngoscope and an Aintree Intubation Catheter.

Whatever technique of tracheal intubation through a "dedicated airway" is used, the vocal cords should be open and non-reactive before attempting to advance the fibrescope or tracheal tube into the trachea. If two attempts at the secondary

tracheal intubation technique fail, surgery should be postponed, and the patient awakened (i.e., Plan C should be implemented).

Plan C: Maintenance of Oxygenation and Ventilation, Postponement of Surgery, and Awakening the Patient-If Plans A and B Have Failed

If Plan B (secondary tracheal intubation technique) fails, it remains important to avoid trauma to the airway and to maintain ventilation and oxygenation with the dedicated airway device. Elective surgery should be cancelled and the airway device should be removed only after muscle relaxation has been reversed, spontaneous ventilation is adequate, and the patient is awake. An alternative plan for anaesthesia can then be made. Although it may be possible to perform surgery under regional anaesthesia, the safest plan is to secure the airway with the patient awake. If adequate ventilation and oxygenation cannot be achieved with the dedicated airway device, ventilation should be performed using a face mask with or without an oral or nasal airway.

If ventilation is impossible and serious hypoxaemia is developing, then Plan D (Rescue techniques for CICV situation) should be implemented without delay (vide infra).

Scenario 2: Unanticipated Difficult Tracheal Intubation-During Rapid Sequence Induction of Anaesthesia (with Succinylcholine) in a Non-Obstetric Patient (Refer to figure 3 of the original guideline document for a flow-chart depicting this scenario.)

Plan A: Initial Tracheal Intubation Plan

In scenario 2, in contrast to scenario 1, there is an increased likelihood of regurgitation or vomiting, with a consequent risk of pulmonary aspiration. The change in management involves the use of pre-oxygenation and the application of cricoid pressure. It is particularly important to use a pre-oxygenation technique which maximises oxygen stores.

Cricoid pressure has played an important role in the prevention of pulmonary aspiration since its introduction by Sellick. It is an integral part of the flow-chart for the patient having rapid sequence induction. However, it can impair insertion of the laryngoscope, passage of an introducer and can cause airway obstruction. A force of 30 Newtons (N) provides good airway protection while minimising the risk of airway obstruction, but it is not well tolerated by the conscious patient. Cricoid pressure should be applied with an initial force of 10 N when the patient is awake, increasing to 30 N as consciousness is lost. The force should be reduced, with suction at hand, if it impedes laryngoscopy or causes airway obstruction.

The principles of optimising the initial tracheal intubation technique, and use of the Eschmann introducer and alternative direct laryngoscopes, are the same as in Plan A in the elective patient. If intubation fails despite a maximum of three attempts, a failed intubation plan with the aim of maintaining oxygenation and awakening the patient (Plan C) is initiated immediately. Further doses of succinylcholine should not be given.

Plan C: Maintenance of Oxygenation and Ventilation and Postponement of Surgery, If Possible

Plan B is omitted from airway management of the patient having rapid sequence induction for two reasons. The risk of regurgitation or vomiting is greater than in the elective patient, so that the risk of aspiration during further attempts at tracheal intubation is higher. The short duration of succinylcholine increases the risk of laryngospasm and difficulty with laryngoscopy during recovery of neuromuscular function, so that further tracheal intubation attempts increase the risk to the patient. When initial attempts at tracheal intubation in this scenario fail, the safest plan in most patients is to postpone surgery and awaken the patient.

Plan C of this scenario contains two subsidiary scenarios, in which the urgency of proceeding with surgery differs. A risk-benefit assessment balances the risks of delaying the surgery against the risk of proceeding with a suboptimal airway. If it is essential to proceed with the surgery, the traditional technique has been to continue with a face mask and oral airway, maintaining cricoid pressure. Continuation of anaesthesia with a classic LMA™ is now an established technique, although not always effective or accepted (effect of cricoid pressure on LMA™ insertion - vide infra). If it proves difficult to ventilate the lungs as a consequence of gas leakage past the cuff of the classic LMA™, use of the ProSeal LMA™ should be considered. The ProSeal LMA™ forms a better seal than the classic LMA™ and provides improved protection against aspiration. The potential advantages of the ProSeal LMA™ have to be offset against increased complexity of insertion (not a problem when a precise technique and the insertion tool are used). The risk (about 5%) of airway obstruction may be lower than that with the classic LMA™. Airway obstruction may be overcome by reinsertion, use of a smaller size, withdrawal of air from the cuff and/or moving the head and neck into the sniffing position. However, poor seal and airway obstruction may be significant problems in some obese patients.

Wherever possible the aim should be to postpone surgery and awaken the patient. Maintenance of ventilation and oxygenation with a face mask is a conventional technique. This may include the one- or two-person technique and the use of an oral or nasal airway. A narrow, soft, lubricated nasopharyngeal airway may be inserted gently if this can be done without trauma. It may be necessary to reduce cricoid force in order to achieve satisfactory ventilation. If satisfactory oxygenation (e.g. oxygen saturation [S_pO_2] >90% with a fraction of inspired oxygen [F_iO_2] of 1.0) cannot be achieved with a face mask, the LMA™ should be used. Cricoid force impedes positioning of and ventilation through the LMA™. It may be necessary to reduce cricoid force during LMA™ insertion when it is used in an emergency.

If ventilation is impossible and serious hypoxaemia is developing, then Plan D (Rescue techniques for CICV situation) should be implemented without delay.

Scenario 3: Failed Intubation, Increasing Hypoxaemia, and Difficult Ventilation in the Paralysed Anaesthetised Patient

Plan D: Rescue Techniques for CICV Situation (Refer to figure 4 of the original guideline document for a flow chart depicting this scenario.)

This scenario may develop rapidly, but often occurs after repeated unsuccessful attempts at intubation in scenarios 1 and 2, where a "can ventilate" situation develops into a CICV situation. It is probable that most patients who suffer hypoxic damage pass through a CICV stage. In situations where mask ventilation fails to oxygenate the patient, the upper airway is normally sufficiently patent to allow gas to escape upwards. This has an important bearing on the efficacy of different airway rescue techniques (vide infra).

Before resorting to invasive rescue techniques, it is essential that a maximum effort has been made to achieve ventilation and oxygenation with non-invasive techniques, such as optimum mask ventilation and the LMA™.

Other supraglottic airway devices, particularly the Combitube™, have been used in the CICV situation. Satisfactory placement of the Combitube is not always possible, even when inserted with a laryngoscope. When properly positioned, it allows ventilation with a higher seal pressure than the classic LMA™, protects against regurgitation, and allows subsequent attempts at intubation while the inflated oesophageal cuff maintains airway protection. Although there have been failures, the Combitube has been used successfully in the difficult intubation and the CICV situation, including failure with the LMA™. Adjustment of cuff pressure may be necessary. The Combitube is a large and bulky device, and there have been some reports of oesophageal damage with the original product, but the risk should be lower with the SA (Small Adult) size. The decision to use the Combitube will depend on availability, experience, and clinical situation.

The risks of an invasive rescue technique must be constantly weighed against the risks of hypoxic brain damage or death. Rapid development of severe hypoxaemia, particularly associated with bradycardia, is an indication for imminent intervention with an invasive technique. Once the decision to perform an invasive technique is made, it is essential to use an effective technique. Rapid reoxygenation is now necessary, and this is best achieved with a combination of an invasive airway device and a ventilation technique which is capable of reliably delivering a large minute volume with an F_iO_2 of 1.0. Many cricothyroidotomy techniques have been criticised because they are not capable of providing effective ventilation.

Classical emergency surgical tracheostomy involves incision through skin and platysma, division of the isthmus of the thyroid gland, haemostasis, incision of the tracheal cartilage, and insertion of a cuffed tracheostomy tube. Emergency tracheostomy can be very difficult and have serious complications. A few surgeons may succeed in 3 minutes, but most will take longer. Delay in completion of tracheostomy in this situation results in death of the patient.

There are a few case reports of successful use of percutaneous tracheostomy techniques in the failed intubation and CICV situation. However, percutaneous tracheostomy techniques include a number of steps and can take time.

The anaesthetist must be prepared to use invasive techniques to secure the airway via the cricothyroid membrane. Success depends on understanding the anatomy of the cricothyroid membrane and of the factors which determine the efficacy of ventilation with different airway devices.

Invasive airway devices which are frequently recommended include:

- Cuffed tracheal or tracheostomy tubes
- Narrow (4 to 6 mm ID) uncuffed tubes
- Cannulae

These must be matched to the ventilation technique in order to provide a system which can deliver a large minute volume. When a cuffed tube is used, a low-pressure ventilation system is satisfactory. When a 4-mm (ID) uncuffed tube is used, successful ventilation is less certain. The "inflated" gas may enter the lungs or flow out through the upper airway. Factors which promote entry of gas into the lungs include high resistance in the upper airway, high lung compliance, high flow rate, and long inflation time. The limitations of the uncuffed tubes in the CICV situation are well summarised by Walls. When a cannula is used, a high-pressure ventilation source is necessary. This system is discussed clearly by Dworkin.

All current airway guidelines recommend management of the CICV situation using:

- Cannula cricothyroidotomy with percutaneous transtracheal jet ventilation (TTJV) or;
- Surgical cricothyroidotomy

They remain the standard techniques.

Cannula cricothyroidotomy: Cannula cricothyroidotomy involves the combination of insertion of a cannula through the cricothyroid membrane with high-pressure ventilation. It can provide effective ventilation, although low success rates have been reported. The DAS recommends use of kink-resistant cannulae because standard intravenous cannulae are easily kinked. The technique is summarised in the flow-chart and is described in detail by Benumof and Stewart. Verification of correct cannula placement by aspiration of air into a large syringe, before the use of high-pressure ventilation, is essential. Subsequent dislodgement of the cannula must be prevented.

A high-pressure source is needed to achieve effective ventilation through a cannula. The oxygen flush systems of most modern anaesthesia machines do not provide sufficient pressure and an adjustable high-pressure device (driven by gas pipeline pressure) with a Luer Lock connection is recommended. Barotrauma is less likely if an initial inflation pressure of less than 4 kilopascals (kPa) (55 pounds per square inch [psi]) is used. Some have recommended insertion of a second cannula to facilitate exhalation. However, the driving pressure for exhalation is relatively low and use of a second cannula is not a reliable means of relieving high airway pressure. Initial high-pressure ventilation should be performed particularly cautiously. It is important to keep the upper airway as open as possible and to verify deflation of the lungs and exhalation through the upper airway. If an LMA has been used, it should be kept in place to facilitate exhalation.

Surgical cricothyroidotomy: Surgical ("stab") cricothyroidotomy can allow rapid restoration of ventilation and oxygenation in the CICV situation and is included in advanced trauma life support (ATLS) and military training. Anaesthetic deaths could be prevented by appropriate use of surgical cricothyroidotomy. Emergency

cricothyroidotomy can result in serious complications, although these are infrequent when staff are well trained. The technique uses low-pressure ventilation through a cuffed tube in the trachea.

A simplified cricothyroidotomy technique can be performed in 30 seconds. This 4-step technique consists of:

Step 1: Identification of the cricothyroid membrane

Step 2: Horizontal stab incision (No. 20 scalpel) through skin and membrane

Step 3: Caudal traction on the cricoid membrane with a tracheal hook

Step 4: Intubation of the trachea

The advanced trauma life support (ATLS) cricothyroidotomy technique includes blunt dilation of the incision made in step 2. It is important to avoid endobronchial intubation when a tracheal tube is used.

Cricothyroidotomy is sometimes particularly difficult in the obese patient. Insertion of the tube can be facilitated by passage of an introducer (bougie) through the incision or use of a tracheal retractor.

Guidewire techniques of cricothyroidotomy have been developed. Some claim that these can restore the airway as quickly as the standard surgical technique, while others have found the guidewire technique to take longer, and to be less satisfactory, as a consequence of kinking of the wires. It has recently been shown that the technique can be performed in 40 seconds after practice in a manikin. The Melker™ guidewire intubation set is now available with a cuffed tube. This technique seems promising but further reports are needed before it can be considered a core rescue technique.

Cannula and surgical cricothyroidotomy each have advantages and disadvantages. Cannula cricothyroidotomy involves a smaller incision with less risk of bleeding. It may be the technique of choice when dedicated equipment is immediately available and staff are trained in its use. If it cannot be performed rapidly, is ineffective, or causes complications, surgical cricothyroidotomy should be performed immediately. Surgical cricothyroidotomy is more invasive. It can be performed very rapidly and will allow effective ventilation with low-pressure sources.

Invasive airway access is a temporary measure to restore oxygenation. Definitive airway management will follow. This may be a formal tracheostomy, but tracheal intubation will be possible in some patients.

CLINICAL ALGORITHM(S)

Clinical algorithms are provided in the original guideline document for:

- The basic structure of the Difficult Airway Society (DAS) guideline flow-chart

- The management of unanticipated difficult tracheal intubation during routine induction of anaesthesia in an adult patient
- The management of unanticipated difficult tracheal intubation during rapid sequence induction of anaesthesia (with succinylcholine) in a non-obstetric patient
- The management of failed intubation, increasing hypoxaemia and difficult ventilation in the paralysed anaesthetised patient

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Controlled studies cannot be performed in unanticipated difficult intubation. The evidence basis of these guidelines best fits the description of expert committee reports, opinions, and experience. All Difficult Airway Society recommendations are supported by at least two case reports or series, the strongest evidence available for infrequent emergency situations.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Reduce the incidence of airway trauma and hypoxaemic damage associated with unanticipated difficult intubation and result in better outcomes for patients

POTENTIAL HARMS

- The Combitube is a large and bulky device, and there have been some reports of oesophageal damage with the original product, but the risk should be lower with the SA (Small Adult) size.
- Emergency tracheostomy can be very difficult and have serious complications. A few surgeons may succeed in 3 minutes, but most will take longer. Delay in completion of tracheostomy in this situation results in death of the patient.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

It is not intended that these guidelines should constitute a minimum standard of practice, nor are they to be regarded as a substitute for good clinical judgment.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

The techniques which have been recommended in these plans should be an integral part of initial and continuing airway training. This can be achieved by acquisition of knowledge in classroom teaching, learning practical skills using manikins in workshops, and use in clinical practice, when appropriate.

There are equipment implications in these guidelines. All the equipment described should be available for regular practice. A cart containing the equipment should be located no more than a couple of minutes from every location where anaesthesia is administered. Recommended equipment lists will be published on the Difficult Airway Society (DAS) Web Site (http://www.das.uk.com).

IMPLEMENTATION TOOLS

Clinical Algorithm

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness
Safety
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004 Jul;59(7):675-94. [314 references] PubMed

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Conflict of interest: Various companies manufacturing/distributing equipment mentioned in the guidelines have contributed to meetings and workshops held by the Difficult Airway Society (DAS) or by the authors. Neither the Difficult Airway Society nor any of the authors have any commercial links with any of these companies.

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This is the current release of the guideline.

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Electronic copies: None available

Print copies: Available from John Henderson, Department of Anaesthesia, Western Infirmary, 1051 Great Western Road, Glasgow G12 0YN

AVAILABILITY OF COMPANION DOCUMENTS

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PATIENT RESOURCES

None available

NGC STATUS

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